

WHAT IS CLAIMED IS:

1. A bidirectional add/drop multiplexer comprising,
 - (1) Two wavelength selective couplers (WSC1, WSC2) with an input port (d1 or d2), an output port (f1 or f2), and a common port (e1 or e2);
 - (2) Two optical isolators (Iso1, Iso2) with an input port (g1 or g2) and an output port (h1 or h2);
 - (3) Two optical circulators (Cir1, Cir2) with an input port (a1 or a2), an output port (c1 or c2) and a common port (b1 or b2);
 - (4) A multiplexing/demultiplexing means with N input/output ports at its both sides; and
 - (5) A mid-stage device composed of a means for compensating the chromatic dispersion of the optical fibers, a means for flattening the spectral responses of the optical amplifiers, a means for suppressing accumulation of the amplified spontaneous emission noise or a combination of these means, and wherein,
 - (6) The output port (f1 or f2) of the wavelength selective coupler (WSC1 or WSC2) is connected to the input port (a1 or a2) of the optical circulator (Cir1 or Cir2);
 - (7) The input port (d1 or d2) of the wavelength selective coupler (WSC1 or WSC2) is connected to the

output port (h1 or h2) of the optical isolator (Iso1 or Iso2);

(8) The input port (g1 or g2) of the optical isolator (Iso1 or Iso2) is connected to an input/output of the multiplexing/demultiplexing means;

(9) The output port (c1 or c2) of the optical circulator (Cir1 or Cir2) is connected to another input/output port of the multiplexing/demultiplexing means; and

(10) The common ports (b1 and b2) of the optical circulators (Cir1 and Cir2) are connected to both ends of the mid-stage device (12).

2. A bidirectional add/drop multiplexer comprising,

(1) Two wavelength selective couplers (WSC1, WSC2) with an input port (d1 or d2), an output port (f1 or f2), and a common port (e1 or e2);

(2) Two optical isolators (Iso1, Iso2) with an input port (g1 or g2) and an output port (h1 or h2);

(3) Two optical circulators (Cir1, Cir2) with an input port (a1 or a2), an output port (c1 or c2) and a common port (b1 or b2);

(4) A multiplexing/demultiplexing means with N input/output ports at its both sides; and

(5) A mid-stage device composed of a means for

compensating the chromatic dispersion of the optical fibers, a means for flattening the spectral responses of the optical amplifiers, a means for suppressing accumulation of the amplified spontaneous emission noise or a combination of these means, and wherein,

(6) The input port (d1 or d2) of the wavelength selective coupler (WSC1 or WSC2) is connected to the output port (c1 or c2) of the optical circulator (Cir1 or Cir2);

(7) The output port (f1 or f2) of the wavelength selective coupler (WSC1 or WSC2) is connected to the input port (g1 or g2) of the optical isolator (Iso1 or Iso2);

(8) The output port (h1 or h2) of the optical isolator (Iso1 or Iso2) is connected to an input/output port of the multiplexing/demultiplexing means;

(9) The input port (a1 or a2) of the optical circulator (Cir1 or Cir2) is connected to another input/output port of the multiplexing/demultiplexing means; and

(10) The common ports (b1 and b2) of the optical circulators (Cir1 and Cir2) are connected to both ends of the mid-stage device (12).

3. A bidirectional add/drop multiplexer as defined

in claim 1 or claim 2, wherein the counter-propagating upstream/downstream signals pass through the mid-stage device in opposite directions each other.

5 4. A bidirectional add/drop multiplexer as defined in claim 1 or claim 2, wherein the multiplexing/demultiplexing means comprises an N x N arrayed waveguide grating router.

10 5. A bidirectional add/drop multiplexer as defined in claim 1 or claim 2, wherein the optical circulator (Cir1 or Cir2) comprises a wavelength selective coupler (WSC3 or WSC4) and two optical isolators ((Iso3, Iso4) or (iso5, Iso6)).

15 6. A bidirectional add/drop multiplexer as defined in claim 1, claim 2, or claim 5, wherein the wavelength selective coupler (WSC1, WSC2, WSC3, WSC4) comprises a wavelength division multiplexer.

20 7. A bidirectional add/drop multiplexer as defined in claim 1, claim 2, or claim 5, wherein the wavelength selective coupler (WSC1, WSC2, WSC3, WSC4) comprises,

25 (1) An optical circulator (Cir4) with an input (d4),

an output (f4) and a common port (e4);

(2) An optical band pass filter (OBPF1) with an input (j1) and an output port (k1) passing the signals with wavelengths in its pass band and blocking off the signals with wavelengths in its stop band; and

(3) An optical band pass filter (OBPF2) with an input (j2) and an output port (k2) whose pass and stop bands are opposite to those of OBPF1, and wherein,

(4) The output port (f4) of the optical circulator (Cir4) is connected to the input port (j1) of OBPF1; and

(5) The input port (d4) of the optical circulator (Cir4) is connected to the output port (k2) of OBPF2.

8. A bidirectional add/drop multiplexer amplifier module comprising,

(1) Two wavelength selective couplers (WSC1, WSC2) with an input port (d1 or d2), an output port (f1 or f2), and a common port (e1 or e2);

(2) Two optical isolators (Iso1, Iso2) with an input port (g1 or g2) and an output port (h1 or h2);

(3) Two optical circulators (Cir1, Cir2) with an input port (a1 or a2), an output port (c1 or c2) and a common port (b1 or b2);

(4) A multiplexing/demultiplexing means with N

input/output ports at its both sides;

(5) A mid-stage device composed of a means for compensating the chromatic dispersion of the optical fibers, a means for flattening the spectral responses of the optical amplifiers, a means for suppressing accumulation of the amplified spontaneous emission noise or a combination of these means; and

(6) Two bidirectional optical amplifiers (BOA1, BOA2) amplifying the counter-propagating signals simultaneously, and wherein,

(7) The output port (f1 or f2) of the wavelength selective coupler (WSC1 or WSC2) is connected to the input port (a1 or a2) of the optical circulator (Cir1 or Cir2);

(8) The input port (d1 or d2) of the wavelength selective coupler (WSC1 or WSC2) is connected to the output port (h1 or h2) of the optical isolator (Iso1 or Iso2);

(9) The input port (g1 or g2) of the optical isolator (Iso1 or Iso2) is connected to an input/output port of the multiplexing/demultiplexing means;

(10) The output port (c1 or c2) of the optical circulator (Cir1 or Cir2) is connected to another input/output port of the multiplexing/demultiplexing means;

(11) The common ports (b1 and b2) of the optical circulators (Cir1 and Cir2) are connected to both ends of the mid-stage device (12); and

(12) The common port (e1 or e2) of the wavelength selective coupler (WSC1 or WSC2) is connected to a bidirectional optical amplifier (BOA1 or BOA2).

9. A bidirectional add/drop amplifier module as defined in claim 8 further comprising two unidirectional amplifiers (UOA1, UOA2) amplifying each way signal, wherein the unidirectional amplifier (UOA1 or UOA2) is inserted between the output port (c1 or c2) of the optical circulator (Cir1 or Cir2) and the multiplexing/demultiplexing means.

10. A bidirectional add/drop amplifier module comprising,

(1) Two wavelength selective couplers (WSC1, WSC2) with an input port (d1 or d2), an output port (f1 or f2), and a common port (e1 or e2);

(2) Two optical isolators (Iso1, Iso2) with an input port (g1 or g2) and an output port (h1 or h2);

(3) Two optical circulators (Cir1, Cir2) with an input port (a1 or a2), an output port (c1 or c2) and a common port (b1 or b2);

(4) A multiplexing/demultiplexing means with N input/output ports at its both sides;

(5) A mid-stage device composed of a means for compensating the chromatic dispersion of the optical fibers, a means for flattening the spectral responses of the optical amplifiers, a means for suppressing accumulation of the amplified spontaneous emission noise or a combination of these means; and

(6) Two bidirectional optical amplifiers (BOA1, BOA2) amplifying the counter-propagating signals simultaneously, and wherein,

(7) The input port (d1 or d2) of the wavelength selective coupler (WSC1 or WSC2) is connected to the output port (c1 or c2) of the optical circulator (Cir1 or Cir2);

(8) The output port (f1 or f2) of the wavelength selective coupler (WSC1 or WSC2) is connected to the input port (g1 or g2) of the optical isolator (Iso1 or Iso2);

(9) The output port (h1 or h2) of the optical isolator (Iso1 or Iso2) is connected to an input/output port of the multiplexing/demultiplexing means;

(10) The input port (a1 or a2) of the optical circulator (Cir1 or Cir2) is connected to another input/output port of the multiplexing/demultiplexing

means; and

(11) The common ports (b1 and b2) of the optical circulators (Cir1 and Cir2) are connected to both ends of the mid-stage device (12).

5 (12) The common port (e1 or e2) of the wavelength selective coupler (WSC1 or WSC2) is connected to a bidirectional optical amplifier (BOA1 or BOA2).

10 11. A bidirectional add/drop optical amplifier module as defined in claim 10 further comprising two unidirectional amplifiers (UOA1, UOA2) amplifying each way signal, wherein the unidirectional amplifier (UOA1 or UOA2) is inserted between the input port (a1 or a2)
15 of the optical circulator (Cir1 or Cir2) and the multiplexing/demultiplexing means.

12. A bidirectional add/drop optical amplifier module as defined in claim 8 or claim 10, wherein the
20 bidirectional optical amplifier (BOA1 or BOA2) comprises one of the followings; a semiconductor optical amplifier, a rare-earth doped optical fiber amplifier, and a Raman optical fiber amplifier.

25 13. A bidirectional add/drop optical amplifier module

as defined in claim 9 or claim 11, wherein each of the
bidirectional optical amplifier (BOA1 or BOA2) and the
unidirectional optical amplifier (UOA1 or UOA2)
comprises one of the followings; a semiconductor
5 optical amplifier, a rare-earth doped optical fiber
amplifier, and a Raman optical fiber amplifier.